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# S O V I E T a n d

## A Digest of Recent Soviet R & D Articles

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## INTRODUCTION

This is a collection of brief abstracts on miscellaneous topics from the current Soviet technical literature. The intent is to supply a quick look at items of possible interest, including topics not necessarily named in the DARPA interest profile, as a supplement to our reportage on specified topics.

It is intended to publish this collection on a monthly basis, to continue to provide prompt coverage of numerous aspects of Soviet R&D. As an added feature, all recently acquired books will be listed as they are received. A list of source abbreviations is appended.

For further information the reader is invited to call Stuart Hibben or Lee Boylan at Informatics on (301)-770-3000.

### New Technique for Measuring Relative Isotope Content (abstract)

A new sensitive method for detecting change in isotope content is reported by V. S. Letokhov's lab, where laser isotope enrichment studies are under way. Two tandem transparent vessels containing isotope mixtures, in this case  $^{10}\text{B}$  and  $^{11}\text{B}$ , are axially excited alternately by two  $\text{CO}_2$  lasers, tuned respectively to the two isotope absorption lines. The first vessel containing a natural isotope mix serves as the standard, and is provided with a pressure-sensing feedback control to maintain laser power constant, where pressure is detected as the product of laser power and line absorption coefficient. Any change in relative isotope content in the second, or test, vessel can thus be registered in terms of signal change in its pressure sensor; capacitive microphones are used as pickups.

Using this technique on  $^{10}\text{B}/^{11}\text{B}$  solutions, Letokhov's group has recorded isotope content changes of 0.5%, although claiming that a theoretical sensitivity of  $10^{-4}\%$  should be attainable. The discrepancy is ascribed to insufficient stabilization of laser outputs. [Gomenyuk, A. S., V. P. Zharov, V. S. Letokhov, and Ye. A. Ryabov. Optoacoustic laser method for measuring relative isotope content in molecules. *Kvantovaya elektronika*, no. 2, 1976, 369-373].

### Laser Gyrocompass (abstract)

A simple design is proposed for a single-element gyrooptical compass, in which a ring laser is used as the sensing element. This scheme can be used for determining meridian during its operation on a stationary base relative to the ground. Characteristics of its quick response, its accuracy in determining meridian direction and the relation between the two are theoretically discussed. From this study a nomogram is drawn, which enables one to determine the required parameters of the ring laser. [Seregin, V. V. Fast response of a gyrooptical compass. *IVUZ Priboro*, no. 12, 1975, 55-58].

### Energy Coupling from an Open Resonator (abstract)

Methods for obtaining r-f energy output from an open resonator using a diffraction radiation oscillator were investigated. The technique described used a coupler of comparatively large dimensions which was placed near the edge of the resonator's spherical reflector. Experimental measurements are presented on coupling coefficient of the oscillator as a function of excitation current. It was shown that the coupling coefficient can be varied with load over wide ranges for all types of oscillation modes excited in the open resonator, by rotating one of the reflectors around its axis and also by changing the distance between the two reflectors. Based on these findings the authors obtain an empirical formula for determining optimum coupling coefficient. [Kurin, V. G., B. K. Skrynnik, and V. P. Shestopalov. Optimizing coupling of a diffraction radiation oscillator with load. *IVUZ Radiofiz*, v. 19, no. 1, 1976, 128-134].

### E-Beam Accelerator Test (verbatim)

Experiments on transmission of heavy-current relativistic electron beam in gas (air) were conducted on the Impul's accelerator. It was shown that the maximum transmitting efficiency is achieved at pressures of 2-3 torr, and can be significantly increased by adding an external axial magnetic field. [Kolomenskiy, A. A., Ye. G. Krastelev, G. O. Meskhi, O. I. Saksonov, and B. Ya. Yablokov. Transmission of heavy-current relativistic electron beams in gas. Kratkiye soobshch. po fiz., no. 6, 1975, 11-14. (RZhF, 12/75, #12V428)].

### E-Beam Injection in the Ionosphere (verbatim)

General theoretical and experimental results are studied on artificial injection of electron beams, their stability and evolution, and analysis of radiation waves. Descriptions are given of the scientific program, preparations, apparatus and results of the first Soviet (Zarnitsa, Feyerverk) and Franco-Soviet (ARAKS) active experiments with controlled initial conditions.

Experimental data is discussed on illumination of the near-rocket region; r-f scatter in ionization inhomogeneities, generated in the ionosphere and in the near-rocket region by injected electron beams; and r-f emission during beam-plasma discharge, at frequencies significantly higher than plasma and Larmor frequencies of a nonturbulent ionosphere. Results analysed include neutralization of rocket charge during electron injection; stimulated particle ejection and VLF radiation amplification; interception of injected electrons (electron echo); and optical effects of injection. The problems and prospects of such active experiments are evaluated. [Zhulin, I. A., V. V. Migulin, and R. Z. Sagdeyev. Active experiments in the ionosphere and magnetosphere (injection of energetic electron beams). In: Sb. XI Vses. konf. po rasprostr. radiovoln, Ch 1, Tezisy dokl. Kazan', Kazan. un-t, 1975, 10. (RZhF, 12/75, #12Zh187)].

### E-Beam Gun (verbatim)

Problems in the generation of intense microsecond electron beams with currents to 40 ka, density of 10 amp/cm<sup>2</sup> and accelerated electron energies to 10<sup>5</sup> ev were investigated. The electron source used was a newly designed gun, consisting of a cold cathode and a feed-through anode, whose aperture is initially filled with plasma. During generation of the initial plasma in the anode aperture, the beam is compensated by positive ions, contracts due to its self-magnetic field and nearly completely passes through the anode hole. The number of electrons striking the anode equalled ~5% of the total flux. In the present experiment, the current pulse duration obtained at an accelerating voltage of 100 kv was up to 2 μsec. The authors conclude that the observed current pulse stretching is caused by the strong focusing action of the "plasma anode lens". [Iremashvili, D. V., T. A. Osepashvili, and P. I. Kakuchaya. Generation of highly intensive microsecond electron beams. ZhTF P, v. 1, no. 11, 1975, 508-511. (RZhF, 11/75, #11G109)].

### Plasma-Target Experiment (abstract)

An experiment in which four plasma jets converged on a copper anode are described. Four plasmatrons with 6 mm diameter nozzles were symmetrically positioned above the water cooled anode, each at 24° to the anode plane. The plasma working medium was either argon or an argon-ammonia mixture; testing was done at atmospheric pressure. Nozzle to impact distance was 55 mm. Data presented on arc parameters at the intersect area shows a generally U-shaped volt-ampere characteristic, for sum currents up to 1 ka. Power to the anode as a function of plasma medium and other parameters is plotted; no direct effects on anode condition are however mentioned. [Nikolayev, A. V., and O. A. Goronkov. Electrical and energetic characteristics of converging plasma arcs. *FizKhOM*, no. 2, 1975, 52-56].

### Soviets Unveil New 6-Meter Azimuth Telescope (abstract)

A new 6-meter telescope has been installed at an elevation of 2 km on Pastukhov Mountain in the northern Caucasus. The 42-ton, 6-m-diameter main reflector was ground and polished out of a 70-ton blank which was annealed over a period of two years. An unusual feature in this telescope is the fact that the telescope's main 600-ton yoke-type mounting axis is vertical and rotates on a film of oil. The reflector and its mount weigh 90 tons. All motions of the telescope systems are computer controlled. The magnification is claimed to be at least x 1,000,000. Most of the work on the telescope was done by the Leningrad Optical and Mechanical Plant. Fifteen years have reportedly been spent on the development of this telescope. [Konovalov, B. Window on space. *Izvestiya*, 20 Feb. 1976, p. 1, cols. 7-8, p. 3, cols. 7-8].

### Night Aerial Photography (verbatim)

Basic scientific and practical problems are outlined on the application of night aerial photography using pulsed electric light sources. Various pulsed lamps (IFK-500; IFK-2000; IFK-20000; IFK-80000; IFP-1200) and their circuit diagrams are briefly described. Comparisons are given of the spectral characteristics of different photomaterials (Izopankhrom-17, Izopankhrom-20; Izopankhrom 15TT-800, Pankhrom 10N-1000) and corresponding light sources. The authors in conclusion stress the need for continued effort in developing methods of night aerial photography, particularly with application to large-scale mapping. [Zykov, K. A., and I. S. Il'inskiy. Some problems of using night aerial photography. *IVUZ Geod.*, no. 2, 1975, 103-109].

### Review of Image Decoding (verbatim)

Problems encountered in decoding of photographic and non-photographic images are discussed. Related questions covered include obtaining a stationary photographic image field; developing reliability criteria for laboratory decoding, and using a system of such criteria for automation of the decoding process; investigating information characteristics of thermal and radar photographs; and investigating the field of application of space photography. [Bogomolov, L. A. Current problems in deciphering photographs and nonphotographic images. *IVUZ Geod.*, no. 2, 1975, 85-89].



### Holographic Imaging System for Ultrasonic Signals (verbatim)

Experimental data are presented on gluing piezoceramic prisms into an ultrasonic polygon, for holographic processing of signals from a multi-element antenna array. An experimental polygon for Rayleigh waves is described. [Kleshnev, Yu. A., V. A. Kuz'min and S. P. Semenov. One type of ultrasonic polygon used for holographic processing of signals received by an antenna array. IN: Leningrad institut aviatsionnogo priborostroyeniya. Trudy, no. 93, 1975, 74-76. (RZhRadiot, 12/75, #12E328)].

### Optical Filter for the Far Infrared Region (verbatim)

A processing technique has been developed and spectral characteristics in the 2.5 to 300 $\mu$  region explored for fine-structured metallic grid plates with 20 to 120 $\mu$  mesh. The mesh apertures are square or circular, and are arranged in checkerboard or honeycomb patterns. At the optimum aperture size to period ratio, the cited structures can be used as bandpass IR filters with a transmission peak wave length  $\lambda_M$  on the order of one period. Transmissivity at the peak is 70 to 90%, the Q value is about 3 and 4-6 for square and circular apertures, respectively. Transmission in the shortwave range at (0.1 to 0.8) $\lambda_M$  wave lengths is 10 to 20%, depending on the aperture size-to-period ratio; at shorter waves, the transmission increases to geometric transparency. Additional filtering elements are required to suppress short wavelength radiation. [Braverman, N. R., L. V. Vorob'yev, V. A. Soglasnova and G. B. Sholomitskiy. Bandpass grid filter for the far infrared region. Preprint No. 223, Moskva, 1975, 22 p. (RZhF, 12/75, #12D1305)].

### Microwave Radiometer for Atmospheric Radiation Study (abstract)

A ground-based radiometer of intermediate sensitivity has been designed and assembled at the Scientific Research Institute of Radiophysics in Gor'kiy for observation of atmospheric thermal radiation at  $\lambda = 5.6$  to 5.7 mm in the range of oxygen resonance absorption. Basic parameters and design features are discussed. The radiometer was used to measure r-f brightness temperature of the atmosphere at -20 to +40° C and 90% relative humidity. The total estimated measurement error was 1.5°K at the optimum operating frequency, 53.4 GHz. Preliminary brightness data obtained in 1973-74 at the Institute test site differed from theoretical values by an average 1 to 2° K, with a maximum  $\sim 2.5^\circ$  K. [Lebskiy, Yu. V., A. P. Naumov, V. M. Plechkov, L. K. Siz'mina, A. V. Troitskiy and A. M. Shtanyuk. A radiometer for ground-based study of atmospheric radiation in the 5 mm spectral range. IVUZ Radiofiz, no. 1, 1976, 25-32].

### Awards in Optics (abstract)

Press accounts of three effects in spectroscopy and nonlinear optics have recently appeared. The team of Il'ina, Klimova and Shpol'skiy at Moscow State Teachers Institute are credited with a liquid crystal solvent in which very sharply defined spectral lines of complex compounds can be obtained. This linear spectroscopic technique has been successfully used to examine over 300 compounds, including chlorophyll.

A joint team of Klyshko et al. at Moscow State University and Grinberg et al. at the Leningrad Physicotechnical Institute are credited with discovering spectrally dispersive properties of a transparent (crystal) medium to laser excitation of sufficient intensity, such that frequencies from the visible up to r-f can be generated; other details are lacking in this account.

The team of Prokhorov, Lugovoy, Dyshko and Korobkin have been credited with the discovery of the lens effect in transparent media exposed to a laser beam, in which discrete high-energy packets appear in the beam path and can under some conditions travel at speeds exceeding light velocity in vacuo.

The awards for observation of these phenomena, which have been earlier reported in the literature, appear to be part of an increased official publicity effort on the Soviets' part to claim credit in these research areas. [Beam "recognizes" matter. Sovietskaya Latvija, 30 Jan. 1976, p. 4; Rainbow of laser light, Leningradskaya pravda, 7 Jan. 1976, p. 1; Discoveries of Soviet scientists, Sov. Latvija, 30 Dec. 1975, p. 2].

#### Closed Cycle MHD Test (abstract)

Results are described of a recent study on pulsed (2 msec) MHD generators with nonequilibrium plasma conductivity. Experiments were conducted with a supersonic Faraday MHD channel at a total thermal power flux of the working medium (argon plus cesium) up to 8 Mw and braking temperatures of  $5 \times 10^3 - 9 \times 10^3$  OK. Measurements were taken of electrical and gasdynamic parameters of the MHD channel and other plasma parameters. MHD conversion efficiency up to 30% was found attainable. [Belykh, A. D., V. A. Garashvili, and V. S. Golubev. Investigating highly efficient MHD generators with nonequilibrium conductivity. IVT, no. 5, 1975, 1064-1071].

#### Superconducting Millimeter and Submillimeter Wave Detector (abstract)

A detector based on a point-contact Josephson junction is reported for recording weak e-m radiation in the 0.3 to 2 mm wavelength range. The detector, which operates as a modulated radiometer, registers radiation by voltage variation across the contact. A differential screw mechanism allows for adjustment of the point contact to desired parameters. A noise level down to  $2 \times 10^{-10}$  v/Hz<sup>1/2</sup> can be attained. At  $\lambda = 1.88$  mm, a  $3 \times 10^4$  v/w peak sensitivity and  $4 \times 10^{-14}$  w/Hz<sup>1/2</sup> threshold sensitivity are reported. The mean temperature sensitivity is 0.05 K/Hz<sup>1/2</sup>. [Divin, Yu. Ya., A. I. Zhukov, F. Ya. Nad', K. A. Rulev and S. Yu. Turygin. A millimeter and submillimeter range radiation detector based on a superconducting point-contact. PTE, no. 6, 1975, 267].

#### New Superconducting Turbogenerators (abstract)

Some details on new models of a superconducting turbogenerator have recently appeared in the press. A one megawatt machine with a 770 mm diameter superconducting rotor has been completed by the VNI Elektromash Institute, using a titanium-niobium winding and liquid helium cooling. Tests have shown a high output efficiency, with rotor weight half that of the usual

generator; weight reduction down to 20% of a standard type is held possible. A number of the medium-range generators are scheduled for production in the current five-year plan, with later development of machines up to 2,000 Mw foreseen.

A companion article describes preparations completed on a 1200 megawatt superconducting generator at the "Elektrosila" combine, although no operating details are mentioned. The designers note a major breakthrough in obtaining an efficiency gain which more than offsets the cost of sustaining superconductivity conditions, thus opening the way to generators in the thousand megawatt range. [Karymov, A. A. A cryoturbogenerator is tested. Leningradskaya pravda, Feb. 17, 1976, p. 4; Zakharov, Yu. Frost serves energy: a superpower generator is developed. Pravda, Feb. 18, 1976, p. 6].

#### Superconducting Film on Sapphire (verbatim)

Conditions are described for vacuum deposition of superconducting niobium film on sapphire. The possibility is shown for etch-polish of the sapphire substrate by a molecular Nb beam. Measurements are given of various electrophysical parameters of the niobium films. [Potapov, S. V., V. P. Polyabov et al. Obtaining superconducting niobium films on sapphire. IN: Sb. Nauchn. tr po probl mikroelektron. Mosk, in-t elektron. tekhn. no. 21, 1975, 24-28. (RZhRadiot, 12/75, no. 12Ye418)].

#### Model of a Superconducting Memory (verbatim)

Differential equations are developed describing transfer (write and read) processes in a tunnel cryotron memory element. A program for solving the equations is presented, and conditions for stable operation of the element are defined. [Knoyfel', G. I. Analog computer modeling of Josephson memory elements. Upravl. sistemy i mashiny, no. 4, 1975, 99-103. (RZhRadiot, 12/75, no. 12Ye405)].

#### Superconducting Millimeter Wave Sensor (abstract)

Test results are described on a granular superconducting material, identified only as a cermet, used as a detector of millimeter band radiation. The design and characteristics of several such receivers are described. The sensitivity, stability and reliability of the granular type are shown to be superior to those of other (solid) superconductors. A receiver using the granular sensor, with a 1.6 GHz bandpass, a sensor rating of  $5 \times 10^5$  v/w, and a low-frequency threshold of  $1.3 \times 10^{-9}$  w/Hz<sup>1/2</sup>, is listed as having a threshold sensitivity of  $10^{-13}$  watt for a monochromatic signal input. Sensors of the superconducting granular cermet type are concluded to be good prospects for radioastronomy. [Kurdyumov, N. N., and L. V. Matveyets. Millimeter radiation sensors using granular superconductors. IN: Sb. VIII Vsesoyuz. konf. po radioastron. Tezisy dokladov. Pushchino, 1975, 70-71. (RZhF, 10/75, no. 10Zh491)].

### Semiconductor Glass Memory (abstract)

Researchers at the Institute of Applied Physics of the Moldavian Academy of Science report tests on a memory effect based on electrically stimulated chemical transformations. The memory element was made by successively depositing a layer of chalcogenide glass semiconductor (CGS) of  $10\mu$  thickness and a semitransparent layer of aluminum on a glass or quartz substrate in vacuum. When an electric field was applied to the structure, changes were noted in optical transmission as well as in reflection from the Al electrode, the rate of change being governed by field intensity and the thickness of the aluminum layer. The transmittance of the specimen increased with applied field and approached a value close to that observed before deposition of the aluminum layer. It was shown that the rate of change of optical parameters in the metal-CGS-metal specimen depends on the conductivity of the CGS layer; hence any external effects that lead to the change in CGS conductivity are automatically recorded in the form of changes in optical density of the structure and its reflectivity. [Andriyesh, A. M., and D. I. Tsiulyanu. Memory effects during electrically stimulated chemical transformations in thin-layered metal-glass semiconductor-metal structures. ZhTF P, v. 2, no. 1, 1976, 38-41].

### High Pressure Treatment of Magnets (abstract)

Effects of pressure treatment up to 60 kbar at temperatures to  $800^{\circ}$  C on the density, stability and magnetic characteristics of permanent magnets are reported, in magnets fabricated from  $\text{SmCo}_5$  powder. Before treatment, cylindrical specimens were first pressed in a nonmagnetic press to 8 kbar in magnetic field of 8000 oe, and then successively pressed at pressures up to 60 kbar. The pressure equipment and treatment procedures are briefly described. Relationships of the density, compression stability and inductance of the specimens are plotted as a function of pressure and temperature.

It was found that treatment up to 60 kbar lowers the porosity of magnets made of  $\text{SmCo}_5$  powder by 3%, increases their stability by 4-6 times and significantly enhances their magnetic characteristics. Increase of pressure over 60 kbar is not recommended, since the relative increment of density and magnetic performance at higher pressures is insignificant. [Bobrovnichiy, G. S., Yu. D. Klebanov, B. V. Rozanov, V. N. Sumarokov, Yu. N. Balalayev, and N. V. Punkin. Effect of ultrahigh pressure treatment on magnetic and mechanical properties of permanent magnets made of a samarium-cobalt compound. FizKhOM, no. 5, 1975, 85-91].

### Lithium Based Anode for Fuel Cell (verbatim)

A patent for an ultra light-weight Li-base alloy is reported which contains (in % by wt): 23 to 38 Mg, 0.5 to 2 Si and 0.01 to 0.2 Mn. Silicon is added to raise the melting point and improve corrosion resistance of the alloy, without changing its electrochemical potential. The alloy is used as fuel (anode) in electrochemical systems. The alloy m.p. is  $230^{\circ}$  and its corrosion rate in water is  $0.08 \text{ mg/cm}^2 \times \text{min}$ . At 1.9 v potential, current density is  $40 \text{ ma/cm}^2$ ; e.m.f. in a nitrate medium at  $170^{\circ}$  is 2.44 v and density is 0.7 to  $0.74 \text{ g/cm}^3$ . [Drits, M. Ye., V. F. Trokhova, I. I. Grudyanov, V. I. Savva, I. M. Kireyev and I. P. Metalikin. A lithium-base alloy. Authors' certificate USSR, no. 465438, published 19 June 1975. (RZhMetal 15I, 2/76, #2I760 P)].

### Chernomor Study of Underwater Optics (abstract)

Results of studies on fluctuations of underwater illumination, conducted during 1962-1972 in the Chernomor underwater laboratory, are analyzed. Based on the experimental data, relationships of the energy spectra of underwater illumination fluctuations are determined as a function of the depth of the observation point, as well as state and conditions of the sea surface illumination. A relation is proposed for calculating the depth at which to expect the peak in the curve of vertical attenuation coefficient of underwater illumination variation. [Prokopov, O. I., V. P. Nikolayev, A. A. Zhil'tsov, and L. M. Nesterenko. Results of the investigation of optical field fluctuations in sea from the Chernomor' underwater laboratory. FAiO, no. 11, 1975, 1179-1183].

### MHD Effect in Seawater (verbatim)

A study is described showing that electric and magnetic field pulsations can occur in water owing to natural turbulence. Magnetic pulsations were measured by a loop, placed on the sea bottom. The loop was over 1000 m long, and about 200 m wide. Spurious external pulsations were excluded by using two loops in a differential scheme. Measurements were conducted in the frequency range of  $6 \times 10^{-3}$  -  $10^{-1}$  Hz. The main causes of the recorded signals were concluded to be MHD effects in the water. At  $3 \times 10^{-2}$  Hz, signals were of the order of 0.1 to 1V. Spectral density of the signals decreased inversely with the squareroot of frequency. [Valeyev, U. S. Electromagnetic fields resulting from MHD effects in sea water and their measurement. IN: Sb. Sovrem. probl. metrol., Vyp. 4. Moskva, 1975, 16-18. (RZhGeofiz, 1/76, #1A338)].

### Underwater Acoustic Holography (verbatim)

A holographic surveillance system is described consisting of an acoustic transmitter in the form of a long narrow cylinder, and a linear receiving antenna using a  $20 \times 20$  matrix of transducer elements. Structural parameters of transmitting and receiving antennas are given, and the electronic circuit for forming the hologram is described, including a pulse shaper, signal processor, synchronizer and reference generator. [Marom, Ye., R. K. Myuller, R. F. Koppelman, and Zh. Zilinskas. Development and preliminary tests of an underwater surveillance system using acoustic holography. IN: Sb. Akust. golografiya. Leningrad, Sudostroyeniye, 1975, 246-259. (RZhRadiot, 11/75, no. 11Ye216)].

### Textbook on Nonlinear Acoustics (abstract)

A newly published monography by Rudenko and Soluyan contains a systematic development of the theory of nonlinear acoustic waves, and of factors governing their propagation. The problem is attacked by a unified method based on the approximation of a slowly varying waveform. Wide use is made of nonlinear equations of the Burgers type. Both approximate and rigorous solutions are given together with their physical analyses. An attempt is made to include the most recent advancements in the theory of nonlinear acoustics.

The authors offer their book as a suitable basic work, but emphasize that neither the text nor the cited references are in any sense a comprehensive treatment of the subject. Among important topics omitted from discussion are parametric transmitters and receivers of ultrasound, laser-generated sound, nonlinear propagation in waveguides, and induced resonant oscillations. Other questions needing fuller study are the propagation of nonlinearly excited rays, focusing and self-action of periodic shock waves, the problem of an effective parametric amplifier, and the nonlinear acoustics of solids.

Chapter headings are as follows:

- o Plane waves of finite amplitude in non-dispersive media.
- o Plane, finite-amplitude waves in viscous, thermally conductive nondispersive media.
- o Spherical and cylindrical waves of finite amplitude.
- o Acoustic waves in dispersive media
- o Interaction of acoustic waves
- o Parametric phenomena in acoustic waves
- o Nonlinear self-action of waves. Effects of higher orders.
- o Acoustic flows
- o Propagation of bounded acoustic rays
- o Statistical phenomena in nonlinear acoustics.

There are 121 Russian and 30 non-Russian references.  
[Rudenko, O. V., and S. I. Soluyan. Teoreticheskiye osnovy nelineynoy akustiki (Theoretical fundamentals of nonlinear acoustics). Moskva, Nauka, 1975, 288 p].

#### Poles Test Manned Habitat-Type Underwater Drilling Platform (extract)

Designed by A. Debski and built at the Gdynia Shipyard, "Geonur" is described as a 4-man habitat capable of several days' stay at a depth of 50 m. Excursions can be made by divers for several hours at a time. Primary breathing-mixture supply is by an umbilical running from a surface-support ship, although a 30-hour independent life-support system is available. Geonur is equipped to perform rescue, construction, and repair operations, as well as to conduct hydrobiological, archeological, and physiological research. The primary missions cited for Geonur are the study of bottom structure, and mineral prospecting. For these roles, Geonur is equipped to drill 100-m-deep boreholes. The system has been successfully tested at sea under wind force 6 conditions. [Underwater base. Nauka i zhizn', no. 1, 1976, 40].

#### Analysis of Dolphin Hearing (abstract)

Some principal characteristics of the active hearing response (20-170 kHz) of dolphins were experimentally investigated. Test were conducted during 1972-74 in a 20 x 15 x 3 m sea basin using divider grids and food motivation. Test types included the following:



1) Detection of a single pulsed signal against a background of other large-amplitude pulsed noise with time lag.

2) Detection of a 40 mm steel ball located at random.

3) Detection of a pair of signals from the difference in time interval between them.

These experiments showd that there is a characteristic time interval in the range of 250-500  $\mu$ sec in the dolphin auditory system. This interval can be regarded as a measure of time resolution, i.e. the interval within which discrete pulsed echo components merge into a complete acoustic image. The presence of this interval helps to explain the dolphin's high noise rejection in echo-ranging and detection of objects near rigid walls and at the bottom, and during the action of pulsed noise with repetition rates up to 1000 pulses/sec. The results further confirm the presence of active sonar combined with passive (0.01-30 kHz) low-frequency hearing, which is characteristic for non-sonar land mammals. [Vel'min, V. A., and N. A. Dubrovskiy. Aural analysis of pulsed sound by dolphins. DAN SSSR, v. 225, no. 2, 1975, 470-473].

#### Wave Tank Tests for Radar Wave Detection (abstract)

Experimental studies to refine radio techniques for measuring air mass movement over sea surfaces are being conducted in the Katsiveli wind-wave flume of the Black Sea Branch of the Marine Hydrophysical Institute (Ukrainian Academy of Sciences) located near Simeiz in Crimea. Water depth in the donut-shaped flume can be varied and wind velocity in the two-meter-wide tank can be changed from 1 to 19 m/sec, thus enabling the simulation of Force 9 (Beaufort) winds.

Refinement of radar techniques for measuring wind velocity over the sea surface, and in particular the measurement of such parameters as ripples on the slopes of large ocean rollers is cited as one of the most immediate tasks confronting radiophysics. However, the cost and time required for extensive, direct ocean-based experiments is prohibitive. One of the advantages of the Katsiveli test tank is that it readily allows both vertical and oblique sounding of the water surface. Although complex radio sounding systems are being developed for the first time in the test tank, the initial test results thus far are described as promising. [Chernobrivets, V. Storms against storms. Vodnyy transport, 7 Feb 1976, p. 4, cols 1-3].

#### Satellite Radiometry of a Sea Surface (verbatim)

Basic principles of determining sea surface temperature [by satellite] are outlined and methods of processing satellite IR data are described, taking into account characteristics of radiation transmission in the atmospheric transparency windows at 3.5-4.1 and 10.5-12.5  $\mu$ . [Galkin, L. N., and D. I. Maksimikhin. Using satellite information for determining sea surface temperature field by IR radiation. Uch. zap. LGU, no. 379, 1975, 64-81. (IzZhGeofiz, 1/76, #1V43)].

### R-F Heating of Sporadic E-Layer (abstract)

Effects of ionospheric heating by powerful r-f emission on the sporadic E-layers are investigated in the framework of wind shift theory, taking into account redistribution of metallic ions. In the case of the regular E-layer, heating of electrons by a strong r-f field causes an increase in its electron density. According to calculations, electron heating up to  $T_e/T = 1.33$  increases density by 7%, while at  $T_e/T = 2$ , density increases by 17%.

In the case of mean-latitude sporadic E-layers, however, the situation is just the reverse. Here heating by powerful r-f fields decreases its electron density and increases its thickness. At mean latitudes the E-layer is made up of mainly metallic ions, for which an ambipolar diffusion process is highly predominant as compared to photochemical reactions. Calculations show that at electron heating up to  $T_e/T = 1.33$ , maximum electron density in the sporadic E-layer decreases by 10%, and at  $T_e/T = 2$ , it decreases by 18%. [Ignat'yev, Yu. A. Effect on the sporadic E-layer of ionospheric heating by powerful r-f emission. IVUZ Radiofiz, no. 9, 1975, 1365-1369].

### Recording VLF Signals in a Magnetically Conjugate Region (verbatim)

Experimental recordings of VLF transmitter signals (15.1 kHz) in a magnetically conjugate region were made in October 1968; the experimental apparatus is described. Magnetospheric signals were observed day and night during the experiment. The signal shape varied widely and sometimes appeared to be modulated regularly at 5 to 8 Hz. The mean delay of the signal corresponded to  $L = 2.65 - 2.8$  [sic] which agreed roughly with transmitter location. [Kiselev, Yu. V., Ya. I. Likhter and O. A. Molchanov. Recording of a VLF-transmitter signal in a magnetically conjugate region. IN: Sb. Ionosfernnye issledovaniya, no. 22, 1975, 81-86. (RZhGeofiz, 1/76, #1A277)].

### Recording of Pc 3 Geomagnetic Pulsations (abstract)

Propagation rates of Pc 3 geomagnetic pulsations (periods from 10 to 45 sec) are estimated, using the measurements of phase and group delays of signals recorded simultaneously at a ground network of stations. The synchronized measurements were made in 1971 from widely-separated Soviet and foreign stations. Phase shift was measured between the most intensive Pc 3 packets at different stations.

Analysis of the observed data shows that phase shifts at the auroral and two intermediate latitude zones take on all possible values from 0 to 180°, and differ from station to station. Delays between signal groups reached 1 to 2 minutes for points up to 1000 to 2000 km distant. The observed delays are concluded to be connected with a low propagation rate of Pc 3 pulsations in the latitudinal direction. The propagation rate is estimated to be from 10 km/sec in the morning hours to 100 km/sec during the day. [Baranskiy, L. N., A. M. Buloshnikov and M. B. Gokhberg. Propagation of Pc 3 geomagnetic pulsations. GiA, no. 1, 1976, 172-174].



### Recent Publications

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# SOURCE ABBREVIATIONS

DAN SSSR	-	Akademiya nauk SSSR. Doklady
FAiO	-	Akademiya nauk SSSR. Izvestiya. Fizika atmosfery i okeana
FiKhOM	-	Fizika i khimiya obrabotka materialov
GiA	-	Geomagnetizm i aeronomiya
IVUZ Geod	-	Izvestiya vysshikh uchebnykh zavedeniy. Geodeziya i aerofotos'yemka
IVUZ Priboro	-	Izvestiya vysshikh uchebnykh zavedeniy. Priborostroyeniye
IVUZ Radiofiz	-	Izvestiya vysshikh uchebnykh zavedeniy. Radiofizika
LC	-	Library of Congress
PTE	-	Pribory i tekhnika eksperimenta
RBL	-	Russian Book List
RZhF	-	Referativnyy zhurnal. Fizika
RZh Geofiz	-	Referativnyy zhurnal. Geofizika
RZh Metal	-	Referativnyy zhurnal. Metallurgiya
RZh Radiot	-	Referativnyy zhurnal. Radiotekhnika
TVT	-	Teplofizika vysokikh temperatur
ZhTF P	-	Pis'ma v Zhurnal tekhnicheskoy fiziki